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AGASSIZ AT PENIKESE.

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AGASSIZ was above all else a teacher. His mission in America was that of a teacher of science—of science in the broadest sense as the orderly arrangement of all human knowledge. He would teach men to know, not simply to remember or to guess. He believed that men in all walks of life would be more useful and more successful through the thorough development of the powers of observation and judgment. He would have the student trained through contact with real things, not merely exercised in the recollection of the book descriptions of things. "If you study Nature in books," he said, "when you go out of doors you can not find her."

Agassiz was once asked to write a text-book in zoölogy for the use of schools and colleges. Of this he said: "I told the publishers that I was not the man to do that sort of thing, and I told them, too, that the less of that sort of thing which is done the better. It is not school-books we want, it is students. The book of Nature is always open, and all that I can do or say shall be to lead young people to study that book, and not to pin their faith to any other."

He taught natural history in Harvard College as no other man had taught in America before. He was "the best friend that ever student had," because the most genial and kindly. Cambridge people used to say that one had "less need of an overcoat in passing Agassiz's house" than any other in that city.

In the interest of popular education as well as of scientific research, Agassiz laid the foundation of the Museum of Comparative Zoölogy. Here, in the face of all sorts of discouragements,

he worked with wonderful zeal, which showed its results in the success of everything with which he had to do.

Of the older teachers of biology in America, the men who were born between 1830 and 1850, nearly all who have reached eminence have been at one time or another pupils of Agassiz. The names of Le Conte, Hartt, Shaler, Scudder, Wilder, Putnam, Packard, Clark, Alexander Agassiz, Morse, Lyman, Brooks, Whitman, Garman, Faxon, Fewkes, Minot, and many others not less worthily known, come to our thoughts at once as evidence of this statement.

Even as late as 1873, when Agassiz died, the Museum of Comparative Zoölogy was almost the only school in America where the eager student of natural history could find the work he wanted. The colleges generally taught only the elements of any of the sciences. Twenty years ago original research was scarcely considered as among the functions of the American college. Such investigators as America had were for the most part outside of the colleges, or at the best carrying on their investigations in time stolen from the drudgery of the class-room. One of the greatest of American astronomers was kept for forty years teaching algebra and geometry, with never a student far enough advanced to realize the real work of his teacher. And this case was typical of hundreds before the university spirit was kindled in American schools. That this spirit was kindled in Harvard forty years ago was due in the greatest measure to Agassiz's influence. It was here that graduate instruction in science in America practically began. In an important sense the Museum of Comparative Zoölogy was the first American university.

Notwithstanding the great usefulness of the museum and the broad influence of its teachers, Agassiz was not fully satisfied. The audience he reached was still too small. Throughout the country the great body of teachers of science went on in the old mechanical way. On these he was able to exert no influence. The boys and girls still kept up the humdrum recitations from worthless text-books. They got their lessons from the book, recited them from memory, and no more came into contact with Nature than they would if no animals or plants or rocks existed on this side of the planet Jupiter.

It was to remedy this state of things that Agassiz conceived, in 1872, the idea of a scientific "camp-meeting," where the workers and the teachers might meet together—a summer school of observation where the teachers should be trained to see Nature for themselves and teach others how to see it.

The first plan suggested was that of calling the teachers of the country together for a summer outing on the island of Nantucket. Before the site was chosen, Mr. John Anderson, a wealthy tobacco

merchant in New York city, offered to Agassiz the use of his island of Penikese, together with a large yacht and an endowment of fifty thousand dollars in money, if he would permanently locate this scientific "camp-meeting" on the island. Thus was founded the Anderson School of Natural History on the island of Penikese.

Penikese is a little island containing about sixty acres of very rocky ground, a pile of stones, with intervals of soil. It is the last and least of the Elizabeth Islands, lying to the south of Buzzard's Bay, on the south coast of Massachusetts. The whole cluster was once a great terminal moraine of rocks and rubbish of all sorts, brought down from the mainland by some ancient glacier, and by it dropped into the ocean off the heel of Cape Cod. The sea has broken up the moraine into eight little islands by wearing tide channels between hill and hill. The names of these islands are recorded in the jingle which the children of that region learn before they go to school:

> "Naushon, Nonamesset, Uncatena, and Wepecket,
> Nashawena, Pesquinese, Cuttyhunk, and Penikese."

And Penikese, last and smallest of them, lies, a little forgotten speck, out in the ocean, eighteen miles south of New Bedford. It contains two hills, joined together by a narrow isthmus, a little harbor, a farm-house, a flag-staff, a barn, a willow tree, and a flock of sheep. And here Agassiz founded his school. This was in the month of June in the year 1873.

From the many hundred applicants who sent in their names as soon as the school was made public Agassiz chose fifty—thirty men, twenty women—teachers, students, and naturalists of various grades from all parts of the country. This practical recognition of coeducation was criticised by many of Agassiz's friends, trained in the monastic schools of New England, but the results soon justified the decision. These fifty teachers should be trained so far as he could train them in right methods of work. They should carry into their schools his own views of scientific teaching. Then each of these schools would become in its time a center of help to others, until the influence toward real work in science should spread throughout our educational system.

None of us will ever forget his first sight of Agassiz. We had come down from New Bedford in a little tug-boat in the early morning, and Agassiz met us at the landing-place on the island. He was standing almost alone on the little wharf, and his great face beamed with pleasure. For this summer school, the thought of his old age, might be the crowning work of his lifetime. Who could foresee what might come from the efforts of fifty men and women, teachers of science, each striving to do his work in the

best possible way? His thoughts and hopes rose to expectations higher than any of us then understood.

His tall, robust figure, broad shoulders bending a little under the weight of years, his large round face lit up by kindly dark-brown eyes, his cheery smile, the enthusiastic tones of his voice, all these entered into our first as well as our last impressions of Agassiz. He greeted us with great warmth as we landed. He looked into our faces to justify himself in making choice of us among the many whom he might have chosen.

The roll of the Anderson School has never been published, and I can only restore a part of it from memory. Among those whose names come to my mind as I write are Dr. Charles O. Whitman, now of Clark University; Dr. William K. Brooks, of Johns Hopkins; Dr. Frank H. Snow, now Chancellor of the University of Kansas; Dr. W. O. Crosby, of the Boston Society of Natural History, then a boy from Colorado interested in rocks and minerals; Samuel Garman, Walter Faxon, Walter Fewkes, and Charles Sedgwick Minot, all of them still connected with the work at Cambridge; Ernest Ingersoll, then just beginning his literary work; Prof. Scott, of the Normal School at Westfield; Prof. Stowell, of the school at Cortland; Prof. Apgar, of Trenton, N. J.; Prof. Fernald, of Maine; Miss Susan Hallowell, of Wellesley College; Miss Mary Beaman (Mrs. Joralemon); Mr. E. A. Gastman, of Illinois; and other well-known instructors. With these was the veteran teacher of botany at Mount Holyoke Seminary, Miss Lydia W. Shattuck, with her pupil and associate, Miss Susan Bowen. Prof. H. H. Straight and his bride, both then teachers in the State Normal School at Oswego, were also with us. These four, whom all of us loved and respected, were the first of our number to be claimed by death.

Among our teachers, besides Agassiz, were Burt G. Wilder, Edward S. Morse, Alfred Mayer, Frederick W. Putnam, then young men of growing fame, with Arnold Guyot and Count Pourtalès, early associates of Agassiz, already in the fullness of years. Mrs. Agassiz was present at every lecture, note-book in hand, and her genial personality did much to bind the company together.

The old barn on the island had been hastily converted into a dining-hall and lecture-room. A new floor had been put in, but the doors and walls remained unchanged, and the swallows' nests were undisturbed under the eaves. The sheep had been turned out, the horse-stalls were changed to a kitchen, and on the floor of the barn, instead of the hay-wagon, were placed three long tables. At the head of one of these sat Agassiz. At his right hand always stood a movable blackboard, for he seldom spoke without a piece of chalk in his hand. He would often give us a

lecture while we sat at the table, frequently about some fish or other creature, the remains of which still lay beside our plates.

Our second day upon the island was memorable above all others. Its striking incident has passed into literature in the poem of Whittier, "The Prayer of Agassiz."

When the morning meal was over, Agassiz arose in his place and spoke, as only he could speak, of his purpose in calling us together. The swallows flew in and out of the building in the soft June air, for they did not know that it was no longer a barn but a temple. Some of them almost grazed his shoulder as he spoke to us of the needs of the people for better education. He told us how these needs could be met, and of the results which might come to America from the training and consecration of fifty teachers.

This was to him no ordinary school, still less an idle summer's outing, but a mission work of the greatest importance. He spoke with intense earnestness, and all his words were filled with that deep religious feeling so characteristic of all his thoughts. For to Agassiz each natural object was a thought of God, and trifling with God's truth as expressed in Nature was the basest of sacrilege.

What Agassiz said that morning can never be said again. No reporter took his language, and no one could call back the charm of his manner or the impressiveness of his zeal and faith.

At the end he said, "I would not have any man to pray for me now," and that he and each of us would utter his own prayer in silence. What he meant by this was that no one could pray in his stead. No public prayer could take the place of the prayer which each of us would frame for himself. Whittier says:

> "Even the careless heart was moved,
> And the doubting gave assent
> With a gesture reverent
> To the Master well beloved.
> As thin mists are glorified
> By the light they can not hide,
> All who gazed upon him saw,
> Through its veil of tender awe,
> How his face was still uplit
> By the old sweet look of it;
> Hopeful, trustful, full of cheer
> And the love that casts out fear."

And the summer went on with its succession of joyous mornings, beautiful days, and calm nights, with every charm of sea and sky, the master with us all day long, ever ready to speak words of help and encouragement, ever ready to give us from his own stock of learning. The boundless enthusiasm which sur-

rounded him like an atmosphere, and which sometimes gave the appearance of great achievement to the commonest things, was never lacking.

Essentially Latin in his nature, he was always picturesque in his words and his work. He delighted in the love and approbation of his students and his friends, and the influence of his personality sometimes gave his opinions weight beyond the value of the investigations on which they were based. With no other investigator have the work and the man been so identified as with Agassiz. No other of the great workers has been equally great as a teacher. His greatest work in science was his influence on other men.

In an old note-book of those days I find fragments of some of his talks to teachers at Penikese. From this note-book I take some paragraphs, just as I find them written there:

"Never try to teach what you do not yourself know and know well. If your school board insist on your teaching anything and everything, decline firmly to do it. It is an imposition alike on pupils and teacher to teach that which he does not know. Those teachers who are strong enough should squarely refuse to do such work. This much-needed reform is already beginning in our colleges, and I hope it will continue. It is a relic of mediæval times, this idea of professing everything. When teachers begin to decline work which they can not do well, improvements begin to come in. If one will be a successful teacher, he must firmly refuse work which he can not do successfully.

"It is a false idea to suppose that everybody is competent to learn or to teach everything. Would our great artists have succeeded equally well in Greek or calculus? A smattering of everything is worth little. It is a fallacy to suppose that an encyclopædic knowledge is desirable. The mind is made strong not through much learning, but by the thorough possession of something."

"Lay aside all conceit. Learn to read the book of Nature for yourself. Those who have succeeded best have followed for years some slim thread which has once in a while broadened out and disclosed some treasure worth a life-long search."

"A man can not be professor of zoölogy on one day and of chemistry on the next, and do good work in both. As in a concert all are musicians—one plays one instrument, and one another, but none all in perfection."

"You can not do without one specialty. You must have some base-line to measure the work and attainments of others. For a general view of the subject, study the history of the sciences. Broad knowledge of all Nature has been the possession of no naturalist except Humboldt, and general relations constituted his specialty."

"Select such subjects that your pupils can not walk without seeing them. Train your pupils to be observers, and have them provided with the specimens about which you speak. If you can find nothing better, take a house-fly or a cricket, and let each one hold a specimen and examine it as you talk."

"In 1847 I gave an address at Newton, Mass., before a Teachers' Institute conducted by Horace Mann. My subject was grasshoppers. I passed around a large jar of these insects, and made every teacher take one and hold it while I was speaking. If any one dropped the insect, I stopped till he picked it up. This was at that time a great innovation, and excited much laughter and derision. There can be no true progress in the teaching of natural science until such methods become general."

"There is no part of the country where in the summer you can not get a sufficient supply of the best specimens. Teach your children to bring them in yourselves. Take your text from the brooks, not from the booksellers. It is better to have a few forms well known than to teach a little about many hundred species. Better a dozen specimens thoroughly studied as the result of the first year's work, than to have two thousand dollars' worth of shells and corals bought from a curiosity-shop. The dozen animals would be your own."

"You* will find the same elements of instruction all about you wherever you may be teaching. You can take your classes out and give them the same lessons, and lead them up to the same subjects you are yourselves studying here. And this method of teaching children is so natural, so suggestive, so true. That is the charm of teaching from Nature herself. No one can warp her to suit his own views. She brings us back to absolute truth as often as we wander."

"The study of Nature is an intercourse with the highest mind. You should never trifle with Nature. At the lowest her works are the works of the highest powers, the highest something in whatever way we may look at it."

"A laboratory of natural history is a sanctuary where nothing profane should be tolerated. I feel less agony at improprieties in churches than in a scientific laboratory."

"In Europe I have been accused of taking my scientific ideas from the Church. In America I have been called a heretic because I will not let my church-going friends pat me on the head."

Of all these lectures the most valuable and the most charming were those on the glaciers. In these the master spoke, and every rock on our island was a mute witness to the truth of his words.

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* In this paragraph, quoted by Mrs. Agassiz (Life and Letters of Agassiz, p. 775), I have adopted the wording as given by her.

He often talked to us of the Darwinian theory, to which in all its forms he was most earnestly opposed. Agassiz was essentially an idealist. All his investigations were to him not studies of animals or plants as such, but of the divine plans of which their structures are the expression. "That earthly form was the cover of spirit was to him a truth at once fundamental and self-evident." The work of the student was to search out the thoughts of God, and as well as may be to think them over again. To Agassiz these divine thoughts were especially embodied in the relations of animals to each other. The species was the thought-unit, the individual reproduction of the thought in the divine mind at the moment of the creation of the first one of the series which represents the species. The marvel of the affinity of structure—of unity of plan in creatures widely diverse in habits and outward appearance—was to him a result of the association of ideas in the divine mind, an illustration of divine many-sidedness. To Darwin these same relations would illustrate the force of heredity acting under diverse conditions of environment.

Agassiz had no sympathy with the prejudices worked upon by weak and foolish men in opposition to Darwinism. He believed in the absolute freedom of science; that no power on earth can give answers beforehand to the questions which men of science endeavor to solve. Of this I can give no better evidence than the fact that every one of the men specially trained by him has joined the ranks of the evolutionists. He would teach them to think for themselves, not to think as he did.

The strain of the summer was heavier than we knew. Before the school came to an end, those who were nearest him felt that the effort was to be his last. His physician told him that he must not work, must not think. But all his life he had done nothing else. To stop was impossible, for with his temperament there was the sole choice between activity and death.

And in December the end came. In the words of one of his old students, Theodore Lyman, "We buried him from the chapel that stands among the college elms. The students laid a wreath of laurel on his bier, and their manly voices sang a requiem. For he had been a student all his life long, and when he died he was younger than any of them."

The next summer, the students of the first year came together at Penikese, and many eager new faces were with them. Wise and skillful teachers were present, but Agassiz was not there, and the sense of loss was felt above everything else. The life was gone out from Penikese, and at the end of the summer the authorities of the museum closed the doors of the Anderson School forever. The buildings stand on the island, just as we left them in 1874, a single old sea-captain in charge of them all these years, until last

winter, when he was lost in a storm. The blackboards in the lecture-hall * still bear the inscriptions left on them by the students and taken from the words of the master:

"STUDY NATURE, NOT BOOKS."

"BE NOT AFRAID TO SAY NO.

"A LABORATORY IS A SANCTUARY WHICH NOTHING PROFANE SHOULD ENTER."

But, while the island of Penikese is deserted, the impulse which came from Agassiz's work there still lives, and is felt in every field of American science.

With all appreciation of the rich streams which in late years have come to us from Germany, it is still true that "the school of all schools which has most influence on scientific teaching in America was held in an old barn on an uninhabited island some eighteen miles from the shore. It lasted but three months, and in effect it had but one teacher. The school at Penikese existed in the personal presence of Agassiz; when he died it vanished!"

NEW CHAPTERS IN THE WARFARE OF SCIENCE.

XV. ASTRONOMY.

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PART II.

WHILE news of triumphant attacks upon him and upon the truth he had established were coming in from all parts of Europe, Galileo prepared a caréful treatise in the form of a dialogue, exhibiting the arguments for and against the Copernican and Ptolemaic systems, and offered to submit to any conditions that the Church tribunals might impose if they would allow it to be printed. At last, after discussions which extended through eight years, they consented, imposing a humiliating condition;—the preface written in accordance with the ideas of Father Ricciardi, Master of the Sacred Palace, and signed by Galileo, in which the Copernican theory was virtually exhibited as a play of the imagination, and not at all as opposed to the Ptolemaic doctrine reasserted in 1616 by the Inquisition under the direction of Pope Paul V.†

* According to Dr. Carl H. Eigenmann, who has lately visited the island.

† As to the general style of the attacks, see Fromundus's book, cited above, *passim*, but especially the heading of chapter vi, and the argument in chapters x and xi. For interesting reference to one of Fromundus's arguments, showing, by a mixture of mathematics and theology, that the earth is the center of the universe, see Quetelet, Histoire des Sciences mathématiques et physiques, Bruxelles, 1864, p. 170; also, Mädler, Geschichte der Astronomie, vol. i, p. 274.